MUSEUM OF NATURAL HISTORY
DEPARTMENT OF GEOLOGY AND GEOGRAPHY
REYKJAVIK

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SUPPLEMENTARY NOTES TO THE LEGEND OF GEOLOGICAL MAP OF ICELAND

SCALE 1:250000

Compiled by

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The *Geological Map of Iceland* is to consist of nine sheets which between them will cover the whole country. Two of the nine sheets — *Sheet 3, South-West Iceland,* and *Sheet 6, South-Central Iceland* — have already appeared. The remaining seven are in preparation and will, it is hoped, be published at the rate of one a year on the average.

Many of the terms used in the necessarily brief explanation of map colours and symbols in the right hand margin of each sheet call for fuller definition, if the map is to be properly understood and made full use of. In the following pages an attempt will be made to provide such definitions. The present pamphlet refers chiefly to the two sheets already published and to *Sheet 5, Central Iceland,* which will be the next to appear, but it will also be found of help in the use of the map as a whole.

A. BEDROCK, TERTIARY AND PLEISTOCENE

All rocks that had crystallised or indurated by other means before the end of the last glaciation. Practically tantamount to "rock" in everyday language with the exception of postglacial "lava rock" (9), silica and calcareous tufa deposits (22) and the hardest varieties of finiglacial moraine (cf. 13). — Occasional loose deposits contained within the bedrock, or otherwise evidently older than some parts of it, also count as part of the bedrock.

1. Basalt Plateau, Tertiary floodbasalts

Light greenish-blue background

The oldest as well as the most extensive and thickest formation of the country, mostly piled up of horizontal or gently dipping basalt beds, in many places interbedded with layers of clastic rocks. Considered to be a part of the *Brito-Arctic Province* of Tertiary flood basalts.

Plant fossils in sedimentary intercalations in the lower part of the

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plateau indicate an Early Tertiary (probably Eocene) age for that part of it, but its range upwards in the scheme of geological time is uncertain. According to a view first put forth by Helgi Pjeturss the topmost series (the "Graue Stufe") of the plateau reaches up into the Quaternary, as indicated especially by traces of glaciation. On the map this series is not distinguished from the main bulk of the formation, which is certainly Tertiary and mostly Early Tertiary in age. .

Intrusions are common in the Basalt Plateau, but only those consisting of acid rocks (rhyolite and granophyre) or gabbro are shown on the map (5, 6 and 7).

2. Old Grey Basalts, Late Tertiary and/or Pleistocene

Greyish-blue background

In many respects similar to the Basalt Plateau (1), especially to the "Graue Stufe", but distinguished from it through thicker intercalations of clastic rocks which in places predominate over the basalts. These intercalations contain voluminous conglomerates, some of which have been interpreted as tillites, as well as palagonite breccias and pillow basalts. These types of rock suggest the presence of ice at the time of their formation and consequently a Quaternary age, of which the occasional presence of Quaternary fossils gives further proof.

Some series of the basalt beds show *normal,* others *reverse* magnetic polarity. Rocks of normal polarity are in places seen to underlie rocks of reverse polarity. In such cases the lower series must have been formed before the last reversal but one of the geomagnetic field, i. e. in Tertiary times.

The boundary between the Old Grey Basalts and the underlying Tertiary plateau (1) is in many places indistinct and is then drawn on the map according to what is suggested by morphological features rather than on the basis of geological research.

Both of these bedrock formations (1 and 2) are distinguished from the younger ones, mentioned below, by being comparatively impermeable to water.

3. Palagonite Formation, Pleistocene

Light brown background

The predominant kind of rock is palagonite tuff and breccia (Icelandic *móberg)* i.e. basic pyroclastic rocks, mostly vitreous in texture

and brown in colour due to alteration (palagonitization) of the glass. The palagonite rocks often contain voluminous intercalations of crystalline basalt showing more or less typical pillow structure.

This formation is but rarely exposed in valleys and plains, but numerous mountains and mountain ranges are entirely made up of it.

Although their rocks are rather soft the palagonite mountains have been little affected by erosion; furthermore, their distribution is closely connected with that of recent volcanoes. Both these facts indicate a low age for the palagonite mountains. The rocks invariably show normal magnetic polarity, which is surely that of the present magnetic cycle beginning near the middle or in the first half of the Pleistocene epoch. The palagonite mountains are reasonably referred to Late Pleistocene.

The morphology as well as the rock structures of the palagonite mountains are considered indicative of their having accumulated subglacially or intraglacially, mostly during the last — but also during the next to the last — glaciation of the Pleistocene.

4. Young Grey Basalts, Pleistocene

Grey background

Basaltic lava flows, often rather light in colour and coarse in texture, poured out after the formation of the main features of the present topography. In this respect they resemble postglacial flows, from which they are, however, easily distinguished by their glaciated surfaces. Clastic intercalations are inconsiderable or wholly absent. Many of the grey flows are easily traced back to their sources, which are in every case shield-volcanoes (19).

The Young Grey Basalts show a close connection with the palagonite mountains (3), both in distribution and in age. At the contacts between these two formations the basalts more often overlie the palagonite rocks, but the reverse case may also be found. Both show normal magnetic polarity.

The grey basalt flows are assumed to have spread out on ice-free land, especially in interglacial times. The ice-scored basalt flows that cap some of the palagonite mountains are also referred to the Young Grey Basalts, notwithstanding the possibility that they were formed during a stage of glaciation when only the top of the mountain rose above the ice sheet.

5. Gabbro

Green background with diagonal shading; G

Any kind of basic plutonic rocks. Only found within the Basalt Plateau (1). Outcrops of gabbro that are too small to be shown in colour are indicated by the letter G, their location being near the centre of the letter.

6. Granophyre, granite

Yellow background with diagonal shading; Gr

Acid fine-coarsegrained intrusive rock. Only found in the Basalt Plateau (1). Small outcrops are marked Gr (cf. 5).

7. Rhyolite

Yellow background

Acid, microcrystalline-vitreous rocks (perlite, pitchstones and obsidian included). Most of them are intrusive, but some have turned out to be of pyroclastic and some of effusive origin. Found scattered in all formations of the bedrock except the Young Grey Basalts. Small exposures are indicated by the letter L (cf. 5).

8. The Sedimentary Series of Tjörnes, Pliocene

Green background

This formation, very rich in marine fossils, is found only on the western coast of the Tjörnes peninsula.

B. SUBSOIL, FINIGLACIAL AND HOLOCENE

All formations younger than the bedrock and overlying it; for the most part loose or poorly indurated deposits, pyroclastic material and lava flows. Cf. A.

The unhardened deposits (sheets of pumice, moraine, alluvium and aeolian sand) are generally shown only where they cover the bedrock thickly and extensively enough to make it inaccessible for investigation.

It should be noted that peat and aeolian soils covered with vegetation are not shown on the map; instead their substratum is shown.

Deep and extensive peat bogs make the mapping difficult in many places, so that inaccuracies are inescapable.

9. Basalt Lavas

Lavender background — light, dark, and spattered with black

Basaltic flows that were never covered by a Pleistocene ice-sheet. In general they were erupted after the last deglaciation, but there are the following exceptions: Pleistocene flows capping volcanic mountains high enough never to have been covered by an ice-sheet after the pouring out of the lava; and, possibly, lava flows in lowlands that became ice-free comparatively early, or before the deglaciation proper.

The lava flows are distinguished according to age as follows: light shade — *old flows,* in general prehistoric, i.e. antedating A.D. 900; dark shade — *young flows,* certainly or presumably historic; dark shade spattered with black — *new flows,* erupted after A.D. 1900.

The age sequence of adjacent lava flows is indicated as follows: In the old lavas (light shade) the margin of the younger flow is outlined in the darker shade, whereas in the young lavas (dark shade) the contact line has small sawteeth pointing into the younger flow. — See also 10.

10. Acid lavas

Yellow background spattered with black

Acid or intermediate lavas often partly consisting of obsidian and differing in colour and surface structure from the far more common basaltic flows.

The distinction between the two types of postglacial lavas (9 and 10) according to acidity is imperfect due to scanty petrographic research. Although far rarer than the basaltic lavas, the acid and intermediate lavas are doubtless not so rare as indicated by the map. For instance, the lavas of Hekla are all shown as basaltic lavas, but some of them have turned out to be andesitic.

11. Coarse pyroclastics and scoriacious lava on volcanoes

Red background

Scoria, bombs, or agglutinate, or a mixture of all these, accumulated above or around a volcanic orifice.

12. Pumiceous sheets

Red dots

Tephra, or unconsolidated pyroclastic material, mostly pumice, spread out to form a sheet thick enough to conceal the substratum more or less completely.

13. Ground-moraine, glacial drift

Blue irregular dashes

Besides boulderclay, or moraine proper, washed and sorted glacial drift, as in eskers and marginal terraces, is included. On the other hand, outwash plains (sandurs) formed in front of glaciers are shown as alluvium (14 or 15).

In several cases it is problematic which symbol is most appropriate — 13, 14 or 15.

It is not intended to show on the map the old hardened moraines (tillites) that are contained in the bedrock in many places, especially in the Old Grey Basalts (2) and the Palagonite Formation (3). Only the "finiglacial and younger" moraines are to be shown (cf. A and B). These young moraines are generally of loose consistence near an uneroded surface, but gradually grow harder with increasing depth, often to the point where they become indistinguishable from the old tillites of the bedrock.

Both for this reason and also because the "finiglacial" is an ill-defined span of time the distinction between the younger moraines and those of the bedrock is often problematic. This is especially true of the areas of the Palagonite Formation (3). It should be mentioned, that the well indurated mantle of "móberg moraine" ("pseudopalagonite") often covering the palagonite mountains is on the map not indicated as moraine, but as belonging to the bedrock.

14. Alluvium

Blue dots

Any kind of fresh-water and marine deposits: gravel, sand, silt and clay. A distinction according to origin or grade would have been in place but turned out to be impracticable. These deposits are often hardly accessible for investigation on account of a thick cover of soil. But even where they are exposed, it is often difficult to decide whether number 13, 14, 15 or 16 is the most appropriate symbol to use.

15. Alluvium with braided river courses

Blue parallel or slightly diverging dash lines

Alluvial plain *in statu nascendi*, overflowed by braided streams. The dash lines show the direction of the watercourses.

16. Aeolian sand

Fine black dots

Icelandic aeolian sands are derived from volcanic ash or river or beach deposits, or a mixture of all these, redeposited by the wind. The degree of redeposition justifying the term "aeolian" is a matter of judgement. In general, aeolian sand is shown only where it forms dunes and is devoid of vegetation or grown only with lyme-grass (*Elymus arenarius*).

17. Area transgressed by the sea or covered by a lake after the last glaciation

Green horizontal broken lines

Areas formerly submerged, either under the sea or under lakes dammed up by glaciers or lava flows. Which was the case is generally evident from the topography. This symbol is only shown on bedrock areas and occasionally on postglacial lava (9) and moraine (13); where the rocks forming the previous sea or lake floors are covered with younger layers, it yields to the symbols appropriate to these layers.

18. Postglacial volcanoes

Different symbols a—e *for different types; drawn in red and (usually) black (on red background (11) only in black).* See Explanation on map.

Volcanic vents that were never covered by a Pleistocene ice-sheet. As a rule they have been active since the end of the last glaciation, but there are exceptions, cf. 9.

A row of small craters is generally shown as an eruptive fissure (a) but in places large craters on fissures are shown separately. A group of closely spaced (small) craters is in some places indicated by a single crater symbol (b). Only in the case of very large craters or calderas, is it possible to show their form; the crater walls are then shown as faults (28). Of subglacial volcanoes (e) only those can be shown that have been observed in activity in historical times, and their location is often only approximate.

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19. Pleistocene shield-volcano

Two symbols, a *and* b

Of the numerous Pleistocene volcanoes only this type is shown on the map. Furthermore, these symbols (19, a and b) only stand for such Pleistocene shield-volcanoes as have been almost or completely buried under a Pleistocene ice-sheet. The lava flows produced by them are on the map shown as Young Grey Basalts (4).

Some of these shield volcanoes have their summit craters so badly preserved that the choice between 19a and 19b is problematic.

20. Pseudocraters

Small red x-es

Mounds of scoria or agglutinate, often conical in shape and with a crater-like depression at the summit. They were formed by "pseudo-volcanic eruptions" up through the solidified crust of a flowing lava, often far away from the volcano and outside the volcanic area. Superheated steam from groundwater contained in a pervious substratum of the lava flow is supposed to be the main explosive agent.

A single symbol may denote a group of pseudocraters.

In some places there is some doubt whether what we have are genuine craters (18b) or pseudocraters (20).

21. Hot springs and mineral springs

Small black circles with blue centres, in most cases accompanied by a symbol denoting the type of spring (a—i). See Explanation on map

Springs rising from great depths in the Earth's crust, as indicated by their high temperatures or chemical properties, or both. Fumaroles, carrying acid vapours but no water in the liquid state, are included (marked b or c). In general, acid springs are poor in water and turbid (mud springs, b). Alcaline springs (d and e) are usually clear; they may be rich in water, and their water boils as it rises. The same is true of warm springs, except that they do not boil; in fact, the temperature of their water may be but slightly above that of "cold springs" with constant temperatures determined by the climate. Carbon dioxide springs (warm, g and h; and cold, i) bubble and thus appear to be boiling. See also 22.

22. Hot spring deposits

Two different symbols, a *and* b

Chemical deposits of alcaline hot springs (silica, siliceous sinter, a) or carbon dioxide springs (calcareous tufa, b). When, as is the case in most places, the chemical deposition is still going on, the symbol for the respective type of spring is combined with that for the deposit.

23. Terminal moraine, a; assumed position of ice-margin, b

a, *solid blue line with short linear "teeth" pointing towards the glacier*

b, *a similar broken line*

Terminal moraines and other terminal and marginal formations of finiglacial age.

24. Young terminal moraine, position of ice-margin in the last few centuries

Like 23, *but with triangular "teeth"*

Analogous with 23 but of a far younger date, being in general due to the advance of glaciers in the 18th and 19th centuries. — Only found near present glaciers and on high mountains.

25. Medial moraine

Chain of blue circles

A narrow belt or strip of debris extending downwards from a nunatak at the junction between two glaciers.

26. Direction of glacial striæ

Arrows

Most of the arrows are crossed at a right angle by a line denoting the observation point; if not, the location is only approximate. Intersecting arrows denote two systems of striæ with different direction, observed at the point of intersection. Where both arrows are solid, it is uncertain which system is the older; where the relative age is known an arrow broken in the middle denotes the older system.

It may be asserted that all striæ indicated by arrows of the usual length (5 mm) were formed during late stages or towards the end of the last Pleistocene glaciation. Occasionally, on high mountains, the direction of striæ due to locally restricted glaciers is shown by means of

shorter arrows (3 mm). Some of these striæ are possibly far younger than the others (cf. 20).

27. Raised beach, finiglacial and younger

Green line

Old shoreline, marked by beach deposits or erosion by sea or lake waves. Cf. 17.

28. Tectonic fractures

Black line with short cross lines a *or teeth* b. See Explanation on map

The fracture lines shown on the map all run through bedrock or postglacial lava. They look fresh and are evidently of postglacial date. Numerous straight-lined trenches and scarps, evidently following bedrock fractures but possibly antedating the last deglaciation, are omitted.

29. Rockslides

Stylized representation in black

Major rockslides from steep mountain sides. The drawing is intended to represent both the scar up on the slope and the debris accumulated at the foot.

Rockslides are rare outside the Tertiary basalt plateau (1). Nearly all of them are of postglacial but prehistoric date.

30. Fossil-bearing localities

a, *snail;* b, *leaf*

Places where megascopic fossil or subfossil remains of animals (a) or plants (b) have been found. Most of the localities are further marked with symbols (letters) denoting the age of the fossils (cf. 32).

31. Lignite

Green line combined with a black zig-zag line

Beds of coal in the bedrock, probably all Tertiary.

The symbol always covers much more space on the map than corresponds to the area of exposure of the bed.

32

Letters attached to the symbols for fossil-bearing localities

Initials of the names of the geological periods to which the fossil fauna or flora belongs. See Explanation on map.

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